Title

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Journal

Behavior Therapy, 51(3)

ISSN

0005-7894

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Publication Date

2020-05-01

DOI

10.1016/j.beth.2019.07.002

Peer reviewed

HHS Public Access

Author manuscript

Behav Ther. Author manuscript; available in PMC 2021 May 01.

Published in final edited form as:

Behav Ther. 2020 May ; 51(3): 401–412. doi:10.1016/j.beth.2019.07.002.

Emotion Regulation Difficulties During and After Partial Hospitalization Treatment Across Eating Disorders

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Abstract

Emotion regulation deficits are associated with eating disorder (ED) symptoms, regardless of eating disorder diagnosis. Thus recent treatment approaches for EDs, such as dialectical behavior therapy (DBT), have focused on teaching patients skills to better regulate emotions. The present study examined changes in emotion regulation among adult patients with EDs during DBT-oriented partial hospital treatment, and at follow-up (M[SD] = 309.58[144.59] days from discharge). Exploratory analyses examined associations between changes in emotion regulation and ED symptoms. Patients with anorexia nervosa, restricting (AN-R, n = 77), and binge-eating/purging subtype (AN-BP, n = 46), or bulimia nervosa (BN, n = 118) completed the Difficulties in Emotion Regulation Scale (DERS) at admission, discharge, and follow-up. Patients with BN demonstrated significant improvements across all facets of emotion dysregulation from admission to discharge, and maintained improvements at follow-up. Although patients with AN-BP demonstrated statistically significant improvements on overall emotion regulation, impulsivity, and acceptance, awareness, and clarity of emotions, from admission to discharge, these improvements were not significant at follow-up. Patients with ANR demonstrated statistically significant improvements on overall emotion dysregulation from treatment admission to discharge. Changes in emotion regulation were moderately correlated with changes in ED symptoms over time. Results support different trajectories of emotion regulation symptom change in DBT-oriented partial hospital treatment across ED diagnoses, with patients with BN demonstrating the most consistent significant improvements.

Keywords

emotion regulation; eating disorders; treatment; dialectical behavior therapy

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Introduction

Treatment outcomes for eating disorders (EDs) are often poor, particularly at higher levels of care, with only a subset of patients achieving and maintaining remission (Anderson et al., 2017; Keel & Brown, 2010). To help refine current treatments and improve outcomes, recent research has focused on identifying psychological features that may perpetuate ED symptoms. Emotion dysregulation is one such relevant feature. Individuals with anorexia nervosa (AN) and bulimia nervosa (BN) consistently demonstrate difficulties with emotion regulation (Lavender et al., 2015). Data suggest that this affective dysregulation plays a key role in the development and maintenance of EDs (Brockmeyer et al., 2014; Harrison, Sullivan, Tchanturia, & Treasure, 2010; Lavender et al., 2015) and changes in emotion regulation prospectively predict changes in AN symptom severity (Racine & Wildes, 2015). However, emotion regulation is a multidimensional construct, and long-term changes in subcomponents of this overarching ability across ED diagnoses have not been examined over the course of treatment.

Given well-documented associations between emotional dysregulation and EDs, recent treatment approaches have focused on using emotion-focused strategies for both AN and BN (Wonderlich & Lavender, 2017), including dialectical behavior therapy (DBT). The theoretical model behind DBT suggests that ED behaviors function to regulate intense emotions. Thus, DBT involves teaching patients new skills to effectively regulate strong emotions. DBT has demonstrated efficacy in improving primary ED symptoms for bulimic-spectrum EDs compared to waitlist (Safer, Telch, & Agras, 2001; Telch, Agras, & Linehan, 2001) and active control conditions (Chen et al., 2017; Safer, Robinson, & Jo, 2010). DBT-based programs have also demonstrated improvements in eating disorder symptoms for AN and BN at higher levels of care, pre- to post-treatment (Ben-Porath, Wisniewski, & Warren, 2010; Brown et al., 2018). To date, no controlled trials of DBT have been conducted in adults with AN. While DBT has been suggested for treating this group (Haynos & Fruzzetti, 2011), to our knowledge, only one case series has examined standard DBT for adults with AN, and found moderate improvements in weight post-treatment (Chen et al., 2015). More broadly, DBT has demonstrated efficacy in improving emotion regulation transdiagnostically (Neacsiu, Eberle, Kramer, Wiesmann, & Linehan, 2014). Thus, DBT appears successful at improving both primary symptoms of various disorders as well emotion regulation difficulties that translate across disorders.

Despite the theoretical relevance for examining changes in emotion regulation over the course of DBT-based ED treatment, relatively few studies have examined this. Regarding DBT trials for outpatient BN, one study found greater improvement in emotion regulation in DBT compared to controls (Safer et al., 2001), while another found no significant differences between DBT and control (Hill, Craighead, & Safer, 2011); however, both studies used the negative mood regulation scale, which does not capture the multifaceted nature of emotion regulation. Two uncontrolled trials have looked at the DERS pre- to post-DBT-focused inpatient/partial hospital treatment (Ben-Porath, Federici, Wisniewski, & Warren, 2014; Rowsell, MacDonald, & Carter, 2016). Rowsell and colleagues (2016) found significant improvements across all DERS subscales in a mixed sample of AN restricting subtype (AN-R) and AN binge-purge subtype (AN-BP) patients, while Ben-Porath and

colleagues (2014) demonstrated improvement in impulse control difficulties, difficulties engaging in goal directed behavior, and non-acceptance of emotional responses in a mixed sample of AN and BN. While these results are encouraging, small overall sample sizes limited the ability to examine differences across diagnoses, particularly among AN subtypes. Further, neither of these studies examined whether improvements observed during treatment were sustained at follow-up, which is critical given that discharge from higher levels of care is often dependent on improvements.

In addition, emotion regulation is a multidimensional construct, and long-term changes in subcomponents of this overarching ability across ED diagnoses have not been examined over the course of treatment. Gratz and Roemer's widely used emotion regulation model (2004) describes emotion regulation across four dimensions: (a) awareness and understanding of emotions; (b) acceptance of emotions; (c) the ability to engage in goal-directed behavior, and refrain from impulsive behavior, when experiencing negative emotions; and (d) access to emotion regulation strategies perceived as effective. Individuals with AN and BN demonstrate similar levels of overall emotion regulation and difficulties across all four dimensions (Lavender et al., 2015), lending support to the conceptualization of emotion dysregulation as a transdiagnostic process associated with EDs. While many studies have found similar levels of emotion dysregulation across AN and BN, few have separately examined AN subtypes. Understanding how emotion regulation may differ over time across AN subtypes, which share similar features (e.g., low weight) but differ on the presence of binge eating/purging, may help clarify emotion regulation difficulties in AN and suggest different treatment strategies across symptom presentations. Individuals with AN-BP, similar to those with BN, demonstrate increased impulsivity, lower self-directedness, and increased reward sensitivity/novelty seeking compared to those with AN-R (Farstad, McGeown, & von Ranson, 2016). While some studies have found no differences between AN subtypes on dimensions of emotion regulation (Danner, Sternheim, & Evers, 2014; Haynos, Roberto, Martinez, Attia, & Fruzzetti, 2014), others have consistently shown that individuals with AN-BP have more difficulty inhibiting impulsive behaviors in times of distress compared to those with AN-R (Anderson et al., 2018; Brockmeyer et al., 2014; Racine & Wildes, 2013). Comparing across AN-R, AN-BP, and BN, Anderson and colleagues (2018) found that at treatment admission patients with AN-BP and BN demonstrated greater difficulties with overall emotion regulation, nonacceptance of emotions, emotional clarity, and impulsivity compared to AN-R.

Thus, to our knowledge, no studies to date have examined changes in multidimensional emotion regulation over the course of DBT-based ED treatment through follow-up in separate ED diagnostic groups within the same sample. While we considered examining outcomes across behavioral symptom profiles (e.g., low weight, binge eating/purging), examination of outcomes across diagnoses permitted direct comparison of our results to the previous literature on this topic at higher levels of care (Ben-Porath et al., 2014; Rowsell et al., 2016). Thus, the present study addresses this gap, and replicates and extends previous work, by examining changes in emotion regulation from partial hospital treatment admission to discharge and from admission to follow-up for adult patients with AN-R, AN-BP, and BN. We hypothesized that all groups would show improvements in emotion regulation over the course of treatment and maintain these improvements through follow-up, but that these

changes would be most pronounced among individuals with AN-BP and BN. Further, although we have previously described changes in ED symptoms in this cohort (Brown et al., 2018), we also explored how changes in emotion regulation were associated with changes in ED symptoms from treatment admission to follow-up in the full sample.

Material and Methods

Participants

The sample consisted of 241 adult patients in a partial hospital EDs treatment program at the University of California, San Diego (UCSD) from February 2011 to May of 2016. All participants met the 2010 draft criteria for the *Diagnostic and Statistical Manual of Mental Disorders - Fifth Edition* (DSM-5; American Psychiatric Association, 2013) AN, BN, or subthreshold AN or subthreshold BN as assessed by one of three facility psychiatrists via semi-structured interview. Subthreshold AN was diagnosed if patients met all criteria for AN, but were not at an objectively low weight (i.e., met criteria for atypical AN). Subthreshold BN was diagnosed if the patient endorsed binge eating and/or purging symptoms at a low frequency/duration. Patients diagnosed with AN or subthreshold AN were classified as having an AN-spectrum disorder, while patients with BN or subthreshold BN were classified as having a BN-spectrum disorder. One hundred and twenty-three patients were diagnosed with an AN-spectrum disorder (n = 77 AN-R, n = 46 AN-BP) and 118 were diagnosed with a BN-spectrum disorder. Our group has previously published ED outcomes from this sample (see Brown et al., 2018).

Procedure

The UCSD Human Research Protections Program approved this study and all participants signed informed consent before completing assessments. Self-report assessments were completed via computer within 14 days of admission and discharge, and at a follow-up assessment. Days since discharge at the follow-up assessment ranged from 78 – 850 days (M[SD] = 309.58[144.59]) and did not differ across diagnoses (p = .80; range, M[SD] AN-R = 89 – 583, 307.83[128.81], AN-BP = 87 – 724, 289.24[163.13], BN = 78 – 850, 318.68[154.32]). Approximately 59% of patients who entered the program completed a discharge assessment (n = 143), and 40% completed follow-up assessment (n = 95). Roughly 33% of the sample (n = 81) completed all three assessment points. Patients who completed all three assessment points had a longer length of stay compared to those missing follow-up (p = 0.008, Cohen's d = .36), a higher lifetime lowest weight (p = 0.007, d = .38), and higher Difficulties Engaging in Goal-Directed Behaviors (p = .02, d = .32). In addition, AN-BP (n = 12/46, 26.1% completers) and BN patients (n = 35/118, 29.7% completers) were less likely to have completed all three assessments compared to AN-R patients (n = 34/77, 44.2% completers; p = 0.05), suggesting potentially biased attrition by diagnosis.

Treatment Program Description

Details on elements of our partial hospital program (PHP) have been described previously (see Brown et al., 2018). Briefly, our clinical program has been adapted from outpatient DBT (Linehan, 1993) to fit a PHP setting for EDs. Patients generally enter our program at the partial hospital level, which involves treatment for 10 hours a day, 6 days a week.

Contingent upon their progress, they step down to 6 hours a day, 5 days a week, and finally to intensive outpatient (IOP), which is 4 hours a day, 3–5 days a week. Regardless of level of care, the program is run according to a behavioral philosophy, and has been designed to include all modes of adherent DBT, including skills groups, phone coaching, therapist consultation team, and individual sessions. Thus, patients are seen for weekly individual DBT sessions, which include diary card review, behavioral chain analysis, and other DBT strategies. Patients participate in twice weekly skills training groups using the DBT Skills manual (Linehan, 2014), as well as various other groups focused on behavioral chain analysis, mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness. The mean length of treatment in PHP and IOP was 88.7 days (SD = 63.2) and did not differ across diagnoses (see Table 1).

Measures

Emotion Regulation Difficulties were assessed using the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), a 36-item multidimensional self-report questionnaire. The DERS includes six subscales: Nonacceptance of Emotional Responses (Nonacceptance), Difficulties Engaging in Goal-Directed Behaviors (Goals), Impulse Control Difficulties (Impulse), Lack of Emotional Awareness (Awareness), Limited Access to Emotion Regulation Strategies (Strategies), and Lack of Emotional Clarity (Clarity). The DERS and all of its subscales have demonstrated adequate internal consistency, test-retest reliability, and convergent validity with other commonly used measures of emotion regulation (Gratz & Roemer, 2004). The internal consistency of the DERS and its subscales ranged from good to excellent in the present sample across admission to follow-up (Total α = .95-.96, Nonacceptance α = .93-.94, Goals α = .89-.91, Impulse α = .89-.92, Awareness α = .88-.90, Strategies α = .92, Clarity α = .88-.90).

Eating Disorder Symptoms were assessed using the Eating Disorder Examination – Questionnaire (EDE-Q; Fairburn & Beglin, 1994), a 31-item self-report questionnaire used to evaluate the presence and severity of ED symptoms during the past 28 days. The EDE-Q Global score was used to measure ED symptoms. Previous research has demonstrated strong psychometric properties of the EDE-Q (Berg, Peterson, Frazier, & Crow, 2011). Internal consistency in the present study was excellent at each timepoint (α = .96 - .97).

Statistical Analyses

To examine change in DERS scores across diagnoses from treatment admission to follow-up, we used linear mixed-effects models techniques using the R lme4 package (Bates, Maechler, Bolker, & Walker, 2015). Relative to ordinary least squares regression, multilevel models more flexibly address the nested structure of our longitudinal data, unevenly spaced assessment points, and missing data. All analyses were run as intent-to-treat (ITT) and full information maximum likelihood (FIML) was used to account for missing data, consistent with recommendations in Schaefer and Graham (2002). The best fitting model to the data was a random intercept, fixed slopes model. Repeated measurements of the DERS subscales nested within participants were included at Level 1. Diagnostic group (AN-R, AN-BP, BN; referent = AN-R) and the interaction between diagnosis and time were modeled at Level 2. Time was modeled as a factor, which allowed flexibility in modeling nonlinear effects and

variation in time between assessment points. Diagnosis-by-time interactions were modeled as the difference in slope from intake and discharge (diagnosis*time2) and intake and follow-up (diagnosis*time3) across diagnosis. Each model included age and age at onset of ED (to account for ED severity/length of illness) as covariates given diagnostic differences in these variables at admission (see Table 1). Length of stay in treatment was also included as a covariate, given substantial variability in treatment length and that treatment dosage could affect outcome. However, given that length of stay did not differ across diagnostic groups, we also ran analyses without this variable as a covariate and results remained unchanged. As an initial correction for multiple comparisons across DERS subscales, our alpha level for statistical significance was set *a priori* at 0.01 within each family of tests for the DERS subscales, while alpha levels were set at 0.05 for DERS Total scores. Post-hoc between-group and time comparisons were Tukey-corrected. To assess clinically meaningful change, reliable change index (RCI) scores were calculated (Jacobson & Truax, 1991) and are presented as the percentage of patients achieving clinically meaningful change.

Given the level of missing data, sensitivity analyses were run using multiple imputation (MI) with the multivariate imputation by chained equations R package (MICE; van Buuren, Groothuis-Oudshoorn, 2011). Five complete data files were imputed using predictive mean matching (max iteration = 50). The pattern of results using MI remained largely unchanged compared to those presented using FIML (see Table S1 for model results).

Exploratory analyses were also run to examine associations between changes in emotion regulation and changes in eating disorder symptoms over time in the full sample (Δ admission to discharge, Δ admission to follow-up, and Δ discharge to follow-up). First, change scores were calculated and then regressed onto the prior time point (e.g., Δ DERS scores from admission to discharge regressed onto admission DERS scores), to account for individual differences in start values. Residuals from these models were then saved and correlated with one another to examine associations between change in emotion regulation and eating disorder symptoms over time.

Results

Demographic and clinical characteristics of the full sample at admission, discharge, and follow-up are reported in Table 1. The majority of the sample (78.8%, $n = 182$) self-identified as non-Hispanic. A total of 74.9% identified as Caucasian, 5.0% as Asian, 1.3% as Black, 0.4% as Native American or Alaska Native, and 18.4% as “other race.” Diagnostic groups did not differ on distributions of race ($p = 0.38$) or ethnicity ($p = 0.96$). Mood and anxiety disorders were the most common comorbidities across diagnoses, although patients with AN-BP and BN were more likely than patients with AN-R to have a mood or alcohol use disorder. Diagnostic groups did not differ on the likelihood of taking antidepressants, atypical antipsychotics, or anxiolytics at admission; however, patients with AN-BP and BN were more likely to be prescribed a mood stabilizer at treatment admission compared to patients with AN-R.

Table 2 presents results from the multilevel models comparing diagnoses over time. On average, individuals with AN-BP had higher DERS Total, Nonacceptance, Impulse, and

Clarity scores compared to individuals with AN-R. Individuals with BN on average demonstrated greater DERS Total, Nonacceptance, Goals, Impulse, Strategies, and Clarity scores compared to individuals with AN-R. Collapsing across diagnosis, there were significant improvements in DERS Total and all subscale scores from admission to discharge (main effect of Time 2), and significant improvements in DERS Total and Awareness scores from admission to follow-up (main effect of Time 3). Individuals with BN also demonstrated a faster decline in DERS Total, Impulse, and Strategies scores from admission to follow-up compared to AN-R.

Table 3 presents means, effect sizes, and RCI estimates on DERS Total and subscales within diagnoses over time. Individuals with AN-R demonstrated significant improvements from admission to discharge on DERS Total score (Cohen's d = .46; RCI = 36%); however this group did not demonstrate statistically significant improvements from admission to follow-up (Cohen's d = .24; RCI = 38.5%). Further individuals with AN-R did not demonstrate statistically significant improvements in any of the DERS subscales scores from admission to discharge (Cohen's d range = .34-.41; RCI range = 12% - 30%) or admission to follow-up (Cohen's d range = .13-.39; RCI range = 13.5% - 35.1%).

Individuals with AN-BP demonstrated significant improvements from admission to discharge on DERS Total, Nonacceptance, Impulse, Awareness, and Clarity (Cohen's d range = .56-.63; RCI range = 28% - 36%); however none of these significant improvements were maintained at follow-up (Cohen's d range = .10-.28; RCI range = 15.4% - 53.8%). Individuals with AN-BP did not demonstrate statistically significant improvement on DERS Goals or Strategies from either admission to discharge (Cohen's d range = .34-.39; RCI range = 28% - 29.2%) or admission to follow-up (Cohen's d range = .15-.20; RCI = 46.2%).

Individuals with BN demonstrated significant improvements on DERS Total and all subscale scores from admission to discharge (Cohen's d range = .39-.61; RCI range = 16.2% - 31%) and admission to follow-up (Cohen's d range = .39-.66; RCI range = 26.3% - 42.1%). Regarding clinical significance, all diagnostic groups scored at least 1 SD above the mean for community norms on DERS Total at treatment admission (M[SD] = 77.99[20.72]; Gratz & Roemer, 2004). Across diagnostic groups, scores were decreased to within one SD of the community mean at treatment discharge and follow-up, with the exception of the AN-BP group.

Table 4 presents exploratory correlations between changes in DERS and EDE-Q scores over time in the full sample. While changes in EDE-Q scores over time across diagnoses have been previously published from this cohort (Brown et al., 2018), EDE-Q scores in the overall sample significantly improved over time (M[SD] admission = 3.84[1.55], M[SD] discharge = 2.39[1.49], M[SD] follow-up = 2.20[1.53], F [2,150] = 43.69, p <.001). Changes in DERS scores from admission to discharge were correlated with change in EDE-Q scores over the same period, but were not associated with any changes in EDE-Q scores through follow-up. Changes in DERS scores from admission to follow-up were associated with changes in EDE-Q scores from admission to follow-up and discharge to follow-up. Changes in DERS score from discharge to follow-up were associated with changes in EDE-Q scores from admission to follow-up and discharge to follow-up.

Discussion

The present study sought to examine changes in emotion regulation over the course of partial hospital treatment and at follow-up for adult patients with EDs. Patients with BN demonstrated significant improvements across all facets of emotion dysregulation, as measured by the DERS, from admission to discharge that were maintained over follow-up. Although patients with AN-BP demonstrated similar significant improvements in DERS Total, Nonacceptance, Impulse, Awareness, and Clarity emotion regulation from admission to discharge, these improvements were not significantly different from admission scores at follow-up. Patients with AN-R started treatment with lower levels of self-reported emotion dysregulation, and demonstrated significant improvements on overall emotion dysregulation from treatment admission to discharge. In the full sample, changes in emotion regulation were moderately associated with changes in eating disorder symptoms over time; however, changes in emotion regulation from admission to discharge were not associated with changes in eating disorder symptoms through follow-up.

Comparing the trajectory of emotion regulation difficulties through follow-up to that of ED symptoms across diagnoses previously examined by our group (Brown et al., 2018), we found somewhat disaggregated outcomes. For the BN group, emotion regulation and ED outcomes appear comparable, with significant improvements on all outcomes at discharge and through follow-up. In combination, these results may reflect the established better prognostic outcomes for BN compared to AN (Keel & Brown, 2010). Results from Brown et al. (2018) demonstrated that the AN-BP group had worse ED outcomes compared with BN and AN-R, with insignificant improvement on purging from intake to discharge, and failure to maintain improvements on binge eating at follow-up. Similarly, within the present study, improvements on emotion regulation in the AN-BP group from intake to discharge were not sustained at follow-up. These findings are also consistent with the relatively poorer prognostic course of AN-BP and high rates of relapse in this group (Steinhausen, 2002). In contrast, the AN-R group started with less pronounced emotion dysregulation and demonstrated significant improvements only on global emotion regulation at discharge, while ED symptoms were significantly decreased at discharge and maintained at follow-up. AN subtypes did not differ on rate of weight gain over time (Brown et al., 2018), suggesting that weight alone could not account for the differential pattern of results across AN groups. While these results appear discordant, they are consistent with the pattern of results from Racine and Wildes (2015), who found that among a mixed sample of patients with AN, high levels of emotion dysregulation predicted subsequent increases and maintenance of AN psychopathology, whereas low levels of emotion dysregulation predicted decreases in AN symptoms. Thus, our results may reflect higher overall DERS scores in the AN-BP as compared to AN-R group in our sample.

Our results are generally consistent with other studies examining changes in DERS over the course of emotion-focused treatment in ED samples (Ben-Porath et al., 2014; Rowsell et al., 2016; Wonderlich et al., 2014) and extend these results by examining patterns of diagnostic differences through long-term follow-up. Patients with BN and AN-BP in the present study demonstrated comparable effect size reductions in DERS scores to those in outpatient integrative cognitive affective therapy (ICAT) and slightly better than those in outpatient

enhanced cognitive behavioral therapy (CBT-E) from admission to discharge (calculated ICAT $d = .73$, calculated CBT-E $d = .50$), while patients with AN-R demonstrated comparable improvements to those in CBT-E. At follow-up, patients with BN also exhibited comparable improvements to those in ICAT and greater improvements compared to CBT-E from admission to 4-month follow-up (ICAT $d = .65$, CBT-E $d = .34$; Wonderlich et al., 2014). Patients with ANBP and AN-R demonstrated improvements comparable to those observed in outpatient CBT-E at follow-up (Wonderlich et al., 2014). Compared to other PHPs, effects from admission to discharge in the present study were slightly larger than the small effects found in Ben-Porath and colleagues (2014) in a mixed AN and BN sample. This may be due to the greater length (approximately 88 days versus 22 days) and intensity (patients start in 10 hour PHP versus 6 hour PHP) of treatment in the present study. In addition, we detected significant improvements in DERS Awareness and Clarity from admission to discharge among separate AN-BP and BN groups that Ben-Porath and colleagues (2014) did not detect in their mixed AN and BN sample.

Our results suggest that patients with AN-BP may demonstrate greater improvements in emotional acceptance, impulse control, and emotional awareness/clarity compared to AN-R over the course of DBT-oriented PHP. However, in interpreting results in the AN-R group, it is important to note that finding a lack of statistically significant change over time does not imply or prove that there are no differences in scores over time. Given smaller sample sizes in the ANBP and AN-R groups compared to the BN group, this likely limited power to detect significant change over time. Thus, results should be interpreted with this in mind. Only two prior studies have examined emotion regulation changes across AN subtypes. In an inpatient sample, Haynos and colleagues (2014) found no improvements on DERS scores and no differences across AN subtypes; however, treatment was not emotion-focused, which may have contributed to the lack of effects. In contrast, an emotion-focused inpatient/PHP (Rowsell et al., 2016) only found greater improvements for AN-BP patients on DERS Impulse. However, the AN sample size in that study was only n=53, which likely limited power to detect other difference between subgroups. Overall, results provide further evidence that emotion regulation deficits among patients with AN-R and AN-BP may show different treatment response trajectories.

Since a major goal of DBT is to help patients learn effective strategies to cope with emotions, it is somewhat surprising that we found significant improvements on DERS Strategies only in the BN group. The lack of statistically significant improvements in the AN-BP and AN-R groups is consistent with results from Ben-Porath and colleagues (2014), but differs from Rowsell and colleagues (2016). While Rowsell and colleagues (2016) found significant improvements in DERS Strategies in a mixed AN group of treatment completers, we found similar small-to medium effect sizes across the AN-R and AN-BP groups to those presented. Thus, the lack of observed significant differences for AN groups in our sample may be due to our statistical methodology, which used a more conservative, intent-to-treat statistical approach.

In the overall sample, changes in emotion regulation were associated with concurrent changes in ED symptoms, suggesting that the trajectory of emotion dysregulation and ED symptoms tend to follow the same pattern. This is consistent with Roswell et al. (2016), who

found that for AN, changes in DERS scores from inpatient/PHP admission to discharge predicted changes in EDE-Q Global scores from admission to discharge. However, our results imply that changes in DERS from admission to discharge may not be associated with changes in EDE-Q through follow-up. This appears to differ from previous research, which found that emotion dysregulation predicted subsequent changes in AN symptoms from treatment discharge through follow-up, using bivariate latent change score models (Racine & Wildes, 2015). However, the authors did not examine how changes in emotion regulation *during* treatment impacted changes in eating disorder symptoms through follow-up, which may account for these differences. Indeed, consistent with Racine & Wildes (2015), we found evidence for concurrent associations between changes in DERS and EDE-Q scores from discharge to follow-up. Notably, given the preliminary and simple nature of our analyses, replication and further examination is needed. Sophisticated modeling of the dynamic relationship between EDE-Q scores and ED symptoms (e.g., bivariate latent change score models) from treatment admission through follow-up may help elucidate this relationship.

Clinical Implications

Results are consistent with the growing literature supporting the efficacy of DBT for BN groups (Bankoff, Karpel, Forbes, & Pantalone, 2012; Safer et al., 2001). Among patients with AN-BP, substantial improvements in emotion regulation were not maintained after discharge, suggesting this group may benefit from additional, prolonged, emotion-focused outpatient treatment. Among patients with AN-R, the lower DERS scores at admission and lack of statistically significant improvement across any specific DERS subscale from admission to discharge or at follow-up could suggest that additional techniques may be helpful to target emotions in this group. As previous research supports that individuals with AN-R demonstrate more overcontrolled, rigid, and compulsive temperament traits (Kaye, Fudge, & Paulus, 2009; Klump et al., 2000) strategies, such as those in Radically-Open DBT, which focus on increasing flexibility, social-connectedness, receptivity, and openness, may also be helpful for AN-R (Lynch et al., 2013). Additional research in this area is needed.

Strengths and Limitations

The current study has several notable strengths including a large sample size, the use of measures with sound psychometric properties, sophisticated modeling techniques, and a naturalistic design, which increases the generalizability of these results compared to randomized controlled trials. However, there are also several important limitations to consider. First, follow-up duration differed across participants enrolled within the study, which limits the conclusions that can be drawn regarding a single point in time after discharge. In addition, survey completion rates at follow-up were relatively low. While low compliance rates at follow-up are common in eating disorder research at higher levels of care (Friedman et al., 2016), it raises concerns regarding reliability and possible selection bias. AN-BP and BN patients were also more likely to have missing assessments, suggesting potentially biased attrition, which may have inflated improvement estimates at discharge. Second, without a no-treatment control group, we cannot determine whether symptom improvement was due to the DBT-based PHP treatment, natural changes in emotion

regulation over time, or some other unaccounted for variable. Additionally, data on medications prescribed over the course of treatment (e.g., mood stabilizers) were not available, which may have had an impact on improvements in emotion regulation over the course of treatment. As such, future research should include a control group or examine programmatic changes pre- and post-implementation of DBT-focused skills training. Third, emotion dysregulation was assessed using a self-report measure, which is subject to memory bias and demand characteristics and requires emotional insight, which may be impaired in eating disorders (Lavender et al., 2015). Fourth, ED diagnoses were established though psychiatrist interview, a process for which reliability has not been previously established. Further, personality disorder diagnoses, in particular, borderline personality disorder were not formally assessed, which may have impacted the trajectory of changes in emotion dysregulation over time. Finally, because the study sample consisted predominantly of female patients presenting for ED treatment at an intensive level of care, our results may be less generalizable to male patients.

Conclusions

In sum, the present study demonstrated differential patterns of improvement across ED diagnoses on emotion regulation during DBT-focused PHP treatment through follow-up, with the most consistent significant long-term outcomes for individuals with BN. Results further reinforce the importance of examining theoretically-relevant outcomes both during and after treatment. Future research in larger, more frequently assessed samples should examine potential differences in emotion regulation outcomes across ED diagnoses and how emotion regulation difficulties and ED symptoms transact throughout treatment and through follow-up. Clarifying the mechanisms of effective ED treatment and the characteristics of patients for whom current treatments work best is critically important to developing and refining interventions for these deadly disorders.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments:

The authors would like to thank and acknowledge the current and past clinical staff for their clinical expertise and support of this research. We would also like to thank all of the patients that contributed to this research.

Funding Sources:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Preparation of this manuscript was supported in part by the National Institute of Mental Health [F32MH108311] to Laura A. Berner.

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Table 1

Sample Characteristics at Admission and Discharge

Characteristic	AN-R *n* = 77 *M(SD)/N(%)*	AN-BP *n* = 46 *M(SD)/N(%)*	BN *n* = 118 *M(SD)/N(%)*	F/X^2	*p*
Age (years)	24.30 (9.16)[a]	26.51 (9.67)[b]	28.19 (9.99)[b]	3.775	.02
Admission BMI (kg/m^2)	17.45 (2.00)[a]	18.65 (1.46)[a]	24.26 (4.62)[b]	101.605	<.001
Discharge BMI (kg/m^2)	19.96 (2.45)[a]	20.05 (1.28)[a]	24.68 (4.51)[b]	53.886	<.001
Female	71 (92.21%)	44 (95.65%)	113 (95.76%)	1.28	.53
Education (years)	14.22 (2.31)	14.96 (2.74)	14.95 (2.24)	2.457	.09
Length of Stay (days)	95.88 (60.96)	95.43 (69.89)	81.46 (61.69)	1.538	.21
Length of Illness (years)	6.40 (9.56)[a]	11.27 (9.55)[b]	9.84 (8.97)[b]	4.784	.01
Age of Onset (years)	17.57 (4.95)[a]	14.69 (2.96)[b]	16.95 (5.08)[a]	5.566	.004
Lifetime Low Weight (lbs)	96.12 (15.55)[a]	97.25 (15.09)[a]	116.67 (22.16)[b]	32.356	<.001
Lifetime High Weight (lbs)	137.87 (33.65)[a]	141.17 (25.52)[a]	166.17 (36.25)[b]	19.016	<.001
Comorbid Disorder at Admission					
Mood Disorder	48 (62.34%)	39 (84.78%)	102 (86.44%)	17.36	<.001
Anxiety Disorder	58 (75.32%)	38 (82.60%)	86 (72.88%)	1.70	.43
Alcohol Use Disorder	1 (1.30%)	5 (10.87%)	12 (10.17%)	8.12	.02
Substance Use Disorder	2 (2.60%)	4 (8.70%)	11 (9.32%)	4.05	.13
Medications at Admission					
Antidepressant	58 (75.32%)	40 (86.96%)	92 (77.97%)	2.44	.30
Atypical Antipsychotic	23 (29.87%)	17 (36.96%)	25 (21.19%)	4.66	.10
Mood Stabilizer	9 (11.69%)	15 (32.61%)	42 (35.59%)	14.17	.001
Anxiolytic	6 (7.79%)	4 (8.70%)	11 (9.32%)	0.14	.93

Note. Superscript of differing values (e.g., a, b) indicate significant differences between groups at $p < .05$. AN-R = anorexia nervosa – restricting subtype; AN-BP = anorexia nervosa – binge/purge subtype; BN = bulimia nervosa; BMI = body mass index.

Table 2

Estimates from Multilevel Models Comparing Diagnoses over Time

	DERS Total		DERS Nonacceptance		DERS Goals		DERS Impulse		DERS Awareness		DERS Strategies		DERS Clarity	
Predictor	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***
Intercept	97.87	<.001	13.44	<.001	16.28	<.001	15.36	<.001	18.57	<.001	20.60	<.001	13.44	<.001
AN-BP	**17.51**	**.001**	**2.54**	**.005**	1.04	.30	**4.31**	**<.001**	1.95	.07	3.65	.02	**2.54**	**.005**
BN	**19.54**	**<.001**	**1.82**	**.01**	**2.57**	**001**	**4.97**	**<.001**	1.83	.03	**4.66**	**<.001**	**1.82**	**.01**
Time 2 (Admit-DC)	**−14.67**	**.001**	**−1.77**	**.009**	**−2.00**	**008**	**−2.49**	**.007**	**−2.23**	**.006**	**−3.67**	**.002**	**−1.77**	**.009**
Time 3 (Admit-Follow-up)	**−9.83**	**.04**	−1.32	.09	−1.42	.10	−1.70	.10	**−2.73**	**.003**	−1.24	.35	−1.32	.09
LOS	0.00	.93	0.00	.89	0.00	.43	−0.01	.13	0.01	.23	−0.01	.43	0.00	.89
Age	0.07	.68	−0.03	.36	0.01	.68	0.02	.63	0.00	.97	0.03	.53	−0.03	.36
Age of Onset	0.01	.98	0.05	.47	0.00	.99	−0.05	.59	−0.07	.37	0.06	.61	0.05	.47
AN-BP*Time2	−5.69	.44	−1.81	.12	−0.11	.93	−1.75	.27	−1.58	.26	−0.07	.97	−1.81	.12
BN*Time2	−6.82	.24	−1.14	.22	−1.26	.22	−2.10	.09	−0.52	.64	−1.20	.45	−1.14	.22
AN-BP*Time3	−0.07	.99	−0.59	.68	0.33	.84	−1.33	.49	1.91	.27	−1.04	.68	−0.59	.68
BN*Time3	**−16.32**	**.01**	−1.69	.11	−2.43	.04	**−3.87**	**.007**	−0.38	.77	**−5.69**	**.002**	−1.69	.11

Note. Referent group is AN-R (anorexia nervosa – restricting subtype). Bolded values indicate significance at the set family-wise error rate of $p = .01$. AN-BP = anorexia nervosa – binge/purge subtype; BMI = body mass index; BN = bulimia nervosa; DC = Discharge; DERS = Difficulties in Emotion Regulation Scale; Total = DERS Total Score; Nonacceptance = DERS Nonacceptance of Emotional Responses; Goals = DERS Difficulties Engaging in Goal Directed Behavior; Impulse = DERS Impulse Control Difficulties; Strategies = DERS Limited Access to Emotion Regulation Strategies; Awareness = DERS Lack of Emotional Awareness; Clarity = DERS Lack of Emotional Clarity; LOS = length of stay

Table 3

Levels of Emotion Dysregulation at Admit, Discharge, and Follow-up across Diagnosis

	Admit	(Admit to) Discharge				(Admit to) Follow-Up			
Variable	**M(SE)**	**M(SE)**	***P***	***d***	**% RCI**	**M(SE)**	***P***	***d***	**% RCI**
DERS Total									
AN-R	100.10 (3.32)	85.43 (3.93)	.02	.46	24.0	90.27 (4.54)	.54	.28	24.3
AN-BP	117.61 (4.26)	97.25 (5.67)	.03	.60	36.0	107.71 (7.45)	.94	.24	38.5
BN	119.64 (2.76)	98.16 (3.63)	<.001	.61	26.2	93.50 (4.36)	<001	.66	42.1
DERS Nonacceptance									
AN-R	13.60 (0.55)	11.83 (0.65)	.20	.34	22.4	12.28 (0.75)	.75	.23	24.3
AN-BP	16.14 (0.71)	12.56 (0.94)	.008	.63	36.0	14.23 (1.22)	.84	.28	30.8
BN	15.42 (0.46)	12.51 (0.60)	<.001	.50	18.0	12.41 (0.72)	.002	.46	36.8
DERS Goals									
AN-R	16.29 (0.61)	14.29 (0.71)	.19	.34	30.0	14.87 (0.82)	.78	.22	35.1
AN-BP	17.33 (0.78)	15.21 (1.03)	.57	.34	28.0	16.23 (1.33)	.99	.15	46.2
BN	18.86 (0.51)	15.60 (0.66)	<.001	.51	31.1	15.01 (0.78)	<.001	.54	34.2
DERS Impulse									
AN-R	14.28 (0.72)	11.79 (0.85)	.16	.36	12.0	12.58 (0.98)	.79	.23	13.5
AN-BP	18.59 (0.92)	14.34 (1.22)	.03	.58	28.0	15.57 (1.60)	.67	.34	53.8
BN	19.25 (0.60)	14.66 (0.78)	<.001	.61	27.9	13.69 (0.94)	<.001	.65	34.2
DERS Strategies									
AN-R	21.84 (0.93)	18.17 (1.10)	.06	.41	20.0	20.59 (1.27)	.99	.13	27.0
AN-BP	25.48 (1.20)	21.74 (1.62)	.41	.39	29.2	23.21 (2.07)	.98	.20	46.2
BN	26.49 (0.78)	21.63 (1.01)	<.001	.50	26.2	19.56 (1.21)	<001	.63	39.5
DERS Awareness									
AN-R	17.88 (0.67)	15.65 (0.79)	.15	.35	18.0	15.16 (0.90)	.09	.39	21.6
AN-BP	19.83 (0.86)	16.03 (1.13)	.03	.56	28.0	19.01 (1.46)	.99	.10	15.4
BN	19.71 (0.56)	16.97 (0.72)	.01	.39	16.4	16.61 (0.86)	.02	.39	26.3
DERS Clarity									
AN-R	13.60 (0.55)	11.83 (0.65)	.21	.36	18.0	12.28 (0.75)	.74	.23	27.0
AN-BP	16.14 (0.71)	12.56 (0.94)	.008	.63	32.0	14.23 (1.22)	.84	.28	38.5
BN	15.42 (0.46)	12.51 (0.60)	<.001	.50	18.3	12.41 (0.72)	.003	.46	29.7

Note. All means are calculated from best-fitting models. All *p*-values reflect analyses using Tukey correction. *d* = Cohen's *d* effect size; % RCI = Percentage of people who made clinically meaningful change according to Reliable Change Index; AN-R = anorexia nervosa – restricting subtype; AN-BP = anorexia nervosa – binge/purge subtype; BN = bulimia nervosa; DERS = Difficulties in Emotion Regulation Scale; Total = DERS Total Score; Nonacceptance = DERS Nonacceptance of Emotional Responses; Goals = DERS Difficulties Engaging in Goal Directed Behavior; Impulse = DERS Impulse Control Difficulties; Strategies = DERS Limited Access to Emotion Regulation Strategies; Awareness = DERS Lack of Emotional Awareness; Clarity = DERS Lack of Emotional Clarity.

Table 4

Correlations between Changes in Emotion Dysregulation and Changes in Eating Disorder Symptoms Over Time

Variable	Δ EDE-Q Admit - Discharge *n* = 75–134	Δ EDE-Q Admit - Follow-up *n* = 74–83	Δ EDE-Q Discharge - Follow-up *n* = 75–76
Δ DERS Admission to Discharge	.69***	.14	−.17
Δ DERS Admission to Follow-Up	.30*	.69***	.63***
Δ DERS Discharge to Follow-up	.12	.63***	.65***

Note.

*$p < .05$.

**$p < .01$.

***$p < .001$. Δ DERS = Change in Difficulties in Emotion Regulation Scale Total Score, EDE-Q = Change in Eating Disorder Examination Questionnaire Global score. Change scores represent scores between the two timepoints listed, with the variance accounted for by the baseline variable removed.